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(71)Applicant : TOYOTA CENTRAL RES & DEV LAB INC  
TOYOTA MOTOR CORP  
DENSO CORP

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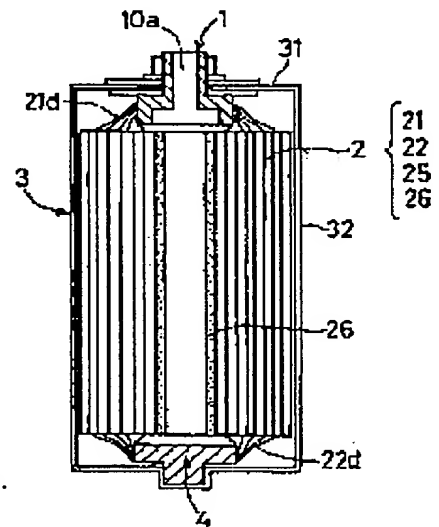
(72)Inventor : WATANABE GORO  
NAKANO AKIRA  
SAEKI TORU  
NOZAKI KO  
TAKEUCHI TOMOYASU

## (54) ENCLOSED ELECTRIC CELL

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an enclosed electric cell which may reduce the number of components without losing the function of a safety device. The safety device is provided as a separate component, which discharge internal gas within the cell into outside environment when internal pressure within the cell is higher than a specific pressure so as to prevent unpredictable situation in that the cell is exploded due to abnormality within the cell.

**SOLUTION:** An external terminal 1 of a closed electric cell comprises terminal body 10 having a gas exhaust hole 10a connected between internal and external environment of a cell case 3, and enclosed component 11 for closing the gas discharge hole 10a and for discharging the gas within the cell case to the outside when the gas pressure within the cell case 3 exceeds a specific pressure. Therefore, the enclosed cell according to this invention may reduce the number of components attached to the cell by combining the external terminal 1 being a dispensable component of the cell with the function of the safety device.



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(71) 出願人 000003609

株式会社豊田中央研究所

愛知県愛知郡長久手町大字長湫字横道41番  
地の1

(71) 出願人 000003207

トヨタ自動車株式会社

愛知県豊田市トヨタ町1番地

(71) 出願人 000004260

株式会社デンソー

愛知県刈谷市昭和町1丁目1番地

(74) 代理人 100081776

弁理士 大川 宏

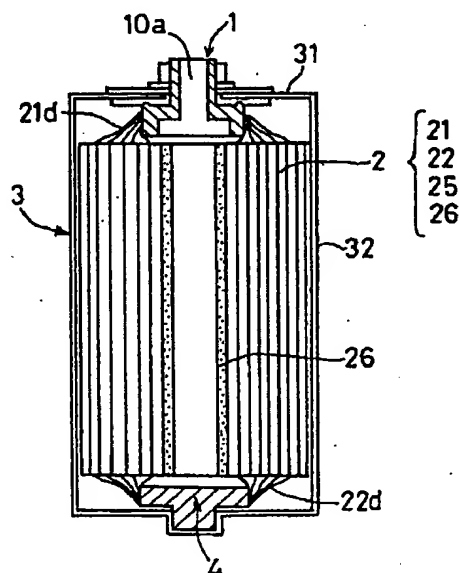
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(54) 【発明の名称】 密閉型電池

(57) 【要約】

【課題】電池内部の異常により電池容器が破裂するといった不測の事態に対処するため、電池内部の圧力が所定圧以上となったときに内部のガスを外部に放出する安全装置が独立して設けられている。本発明は、この安全装置の機能を損なわずに、電池への組み付け部品点数を削減した密閉型電池の提供を目的とする。

【解決手段】密閉型電池の外部端子1は、電池ケース3の内外を連通するガス抜き穴10aをもつ端子本体10と、該ガス抜き穴10aを封止し、該電池ケース3内のガス圧が所定圧以上に達したときに該電池ケース3内のガスを外部に放出させる封口部材11とを有する。つまり、本発明の密閉型電池は、安全装置の機能を電池の必須部品である外部端子1に兼ね備えることにより、電池への組み付け部品点数を削減するものである。



## 【特許請求の範囲】

【請求項1】 電池ケースと、該電池ケースの内部に封入収納された正極、負極および電解液と、該正極および該負極のいずれか一方に電気的に接続され該電池ケースを貫通した状態で該電池ケースに密封保持された外部端子を有する電池であって、

該外部端子は、該電池ケースの内外を連通するガス抜き穴をもつ端子本体と、該ガス抜き穴を封止し、該電池ケース内部のガス圧が所定圧以上に達したときに該電池ケース内部のガスを外部に放出させる封口部材とを有する

ことを特徴とする密閉型電池。

【請求項2】 前記封口部材は、前記端子本体の前記電池ケース内部に位置する部分を被覆する請求項1記載の密閉型電池。

【請求項3】 前記端子本体の前記電池ケース内部に位置する部分は、該端子本体の該電池ケース外部に位置する部分よりも径の大きい太径部をなし、

該太径部は、前記外部端子が保持される該電池ケースの内壁に面するフランジ面を有し、

該外部端子は、該フランジ面と該電池ケース内壁との間にガスケットを挟持して該電池ケースに密封保持されている請求項2記載の密閉型電池。

【請求項4】 前記太径部は、前記フランジ面の外縁に、該フランジ面より突出する環状の突起部を有し、前記封口部材は、該突起部を巻き込んで該突起部に係止されている請求項3記載の密閉型電池。

【請求項5】 前記封口部材は、その一部に弱体部を有する請求項1ないし4のいずれかに記載の密閉型電池。

【請求項6】 前記弱体部の形状は、環形または環形の一部が欠損した形状である請求項5記載の密閉型電池。

【請求項7】 前記外部端子は、該電池ケースの内部のガス圧により変形する封口部材を穿孔または破断させるための突起部材を有する請求項1ないし6のいずれかに記載の密閉型電池。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、電池の内部圧力が所定圧に達した際に電池内部のガスを電池外部に放出させる安全装置を備えた密閉型電池に関する。

## 【0002】

【従来の技術】 電話、パソコン等の通信機器、情報関連機器のコードレス化、小型化や、電気自動車への関心の高まりから、電源となる電池の大容量化、高エネルギー密度化が急速に進展している。ニッケルカドミウム電池、ニッケル水素電池を経て、現在ではリチウム電池が一部の分野で実用化されるに至っている。

【0003】 リチウム電池をはじめとするこの様な高エネルギー密度の電池では、高活性な電池反応が起こるがゆえに高い安全性が求められる。例えば、電池内部の短絡、過充電、加熱等の原因から、電池内部でガスが多量

に発生して電池容器の内圧が異常に上昇し、電池容器が破裂するといった不測の事態にも対処しなければならない。そこでリチウム電池等の密閉型電池の電池ケースでは、通常、電池の内部圧力が所定圧以上になった場合に、内部に発生したガスを外部に放出する安全装置が設けられている。

【0004】 この安全装置は、電池ケースにガス抜き穴を設け、このガス抜き穴に例えば肉圧の薄い金属または樹脂を接合させることにより固定し、この金属または樹脂を圧力開放弁として用いる安全弁が一般的である。電池の内部圧力が電池の異常により急増した場合は、この安全弁が破裂し、電池内部のガスを外部に放出するように機能して、電池内部を減圧するものである。

【0005】 その付設場所としては、特開平9-92249号公報では、安全装置として上述のような圧力開放弁としての安全弁を独立の部品として電池ケース蓋の一部分に設置した構造を開示している。また特開平1-311558号公報でも、同じく安全弁を独立の部品として電池ケース蓋に熱接着している。さらにまた特開平9-199088号公報でも、やはり独立の部品として金属薄板の安全弁を電池ケース蓋にレーザ溶接している。

## 【0006】

【発明が解決しようとする課題】 しかし、安全装置を電池ケース蓋に取り付けると、多くの部品を電池ケース蓋に取り付ける必要が生じ、それだけ電池ケース蓋の面積が増加することとなり、例えば円筒型電池においては、電池の径を太くする必要が生じ、細径電池には使用できないという欠点がある。そして安全装置を独立した部品とすると、電池への組み付け部品点数が増加し、その組み付け・設置するための行程が増えるため、コスト・生産性の面で不利になる。

【0007】 本発明者らは、この課題に鑑み、電池の必須部品である外部端子に安全装置の機能を備える余地のあることに着目した。

【0008】 本発明はこのような着目により想到されたものであり、安全装置の機能を損なわずに、電池への組み付け部品点数を削減した密閉型電池を提供することを目的とする。

## 【0009】

【課題を解決するための手段】 すなわち上記課題を解決する本発明の密閉型電池は、電池ケースと、電池ケース内に封入収納された正極、負極および電解液と、該正極および該負極のいずれか一方に電気的に接続され該電池ケースを貫通した状態で該電池ケースに密封保持された外部端子を有する電池であって、該外部端子は、該電池ケースの内外を連通するガス抜き穴をもつ端子本体と、該ガス抜き穴を封止し、該電池ケース内のガス圧が所定圧以上に達したときに該電池ケース内のガスを外部に放出させる封口部材とを有することを特徴とする。

【0010】 つまり、本発明の密閉型電池は、安全装置

の機能を電池の必須部品である外部端子に兼ね備えることにより、電池への組み付け部品点数を削減するものである。なお、本発明の密閉型電池の特徴部である、安全装置の機能を兼ね備えた外部端子を以下、「安全装置付外部端子」という。

【0011】

【発明の実施の形態】以下に本発明の密閉型電池の実施形態について、図面を参照しつつ詳細に説明する。以下の説明はリチウムイオン二次電池についてのものであるが、本発明の密閉型電池はこのリチウムイオン二次電池に限られず、電池を構成する内容物を密閉する構造の電池であれば、いずれの種類の電池であるかは問わない。例えばニッケルカドミウム電池、ニッケル水素電池、実施形態で挙げた以外のリチウム電池等である。特にリチウムイオン二次電池を始めとするリチウム電池は、有機電解液を使用しているためより高い安全性が要求されることから、本発明を適用する効果大きい。また本発明の密閉型電池の特徴とする安全装置付外部端子構造は、活性炭を活性物質として含む電極合材を集電体の表面に層状に形成させた電極を有する電気二重層キャパシタに対しても適用可能であるため、本明細書において「電池」とは「キャパシタ」の意味をも含むものとする。なお、図面については、要部のみを模式的に表したものであるため、細部の形状、縮尺等についてまで正確に表現したものとなっていない。

【0012】図1に、本発明の密閉型電池の一実施形態である円筒型リチウムイオン二次電池の断面図を模式的に示す。

【0013】本密閉型電池は、正極21と負極22とを、セパレータ25を介し、巻芯26を中心に巻回して形成した電池内容物2（以下「電極体」という。）を有し、この電極体2は電解液と共に筒型の電池ケース3に挿設されている。そして、その正極21と電氣的に接続され、該電池ケース3を貫通した状態で該電池ケース3に保持された安全装置付外部端子1を有する。なお、本実施形態の密閉型電池では、安全装置付外部端子1は正極21に電氣的に接続されているが、本発明の密閉型電池の安全装置付外部端子は正極に電氣的に接続される場合に限られず、負極に電氣的に接続してもよい。また安全面から、より広面積のガス抜き穴が必要であるならば正極、負極の外部端子の双方を安全装置付外部端子としてもよい。このときに安全装置付外部端子を採用しなかった側は、別に安全装置付でない外部端子を設けたり、また電池ケースの一部を外部端子として利用する等の公知の形態の外部端子とすることができる。

【0014】図2に、本実施形態の密閉型電池の電極体の斜視図を、図3に、本実施形態の電極体の展開図をそれぞれ模式的に示す。

【0015】電極体2は、正極21と負極22を、正極リード21d、負極リード22dがそれぞれ背向するよ

うに配置し、それらと2枚のセパレータ25が、正極21、セパレータ25、負極22、セパレータ25の順に繰り返して積重し、これらを一体として巻芯26に渦巻状に巻回し、円筒形とする。なお、電極体2の形状は、円筒形に限られず、複数の正極、負極、セパレータを積層して角形とすること等も可能である。

【0016】正極21は、帯状金属箔製の正極集電体21aとその両面に塗工された正極合材21bと正極集電体の幅方向の一端部（正極合材未塗工部21c）に形成された集電用の正極リード21dから構成される。負極22は帯状金属箔製の負極集電体22aとその両面に塗工された負極合材22bと負極集電体22aの幅方向の一端部（負極合材未塗工部22c）に形成された集電用の負極リード22dから構成される。正極21、負極22には、幅方向の一端部に所定幅で全長にわたって正極合材未塗工部21cおよび負極合材未塗工部22cがそれぞれ設けられている。正極21および負極22の長さおよび幅については、作成しようとする電池の容量等に応じて任意のものとすることができる。

【0017】正極集電体21aには、アルミニウム等の金属箔を用いればよい。正極合材21bは、リチウム複合酸化物粉末等からなる正極活性物質に黒鉛等の導電材、ポリフッ化ビニリデン等の結着剤を混合したもの等の公知のものを用いればよい。負極集電体22aには、銅等の金属箔を用いればよい。負極合材22bは、黒鉛等の炭素材料粉末からなる負極活性物質に、ポリフッ化ビニリデン等の結着剤を混合したもの等の公知のものを用いることができる。

【0018】正極リード21d及び負極リード22dは、各電極の集電体21a、22aと同じ金属を用いるのが好ましい。従って正極ではアルミニウム等、負極では銅等を用いる。その形態は短冊状等とすればよい。正極リード21d、負極リード22dの数は放電容量が大きくなるにつれて内部抵抗を低くするため、複数にする必要がある。本実施形態では大容量電池を用いているため正極リード22d、負極リード22dともに複数となっているが、リードの数は特に問わない。

【0019】巻芯26は、本リチウムイオン二次電池の場合、円柱状の形状としている。但し電極体2の形状に応じて、種々の形状、例えば電極体2に応じて四角柱等の多角形の横断面をもつもの、楕円形の断面をもつものなどであっても構わない。

【0020】セパレータ25は、正極21および負極22を電氣的に絶縁し、電解液を保持する役割を果たすものである。例えば、ポリエチレン等の微多孔質膜を用いればよい。なおセパレータ25は、正極21と負極22との絶縁を担保するため、正極21、負極22よりもさらに大きいものとするのが好ましい。

【0021】本実施形態における電池ケース3は、有底の中空円筒状のケース本体32と、ケース本体の上端を

閉塞する電池ケース蓋31とからなる。この電池ケース蓋31の中央部には、外部端子用孔が設けられており、この外部端子用孔に、安全装置付外部端子1が挿入される。電池ケースは、本実施の形態においては円筒形であるが、円筒形に限られるものではなく、電極体の形状に合わせて角型等としてもよい。その場合には、その形状に応じた壁面部材により、電池ケースが構成される。

【0022】本発明の密閉型電池の特徴部である安全装置付外部端子は、電池ケースの内外を連通するガス抜き穴をもつ端子本体と、ガス抜き穴を封止し、電池ケース内のガス圧が所定圧以上に達したときに該電池ケース内のガスを外部に放出させる封口部材とを有することを特徴とする。

【0023】図4に本実施形態の安全装置付外部端子の斜視図を、図5に本実施形態の安全装置付外部端子の各構成部分を、図6に本実施形態の安全装置付外部端子の製造法をそれぞれ模式的に示す。

【0024】本実施形態の安全装置付外部端子1は、端子本体10と、封口部材11から構成されている(図5(a)参照)。この端子本体10と封口部材11は、本実施形態では全体が金属製であり、導電性を有している。なお、安全装置付外部端子は、電池ケース内と電池ケース外を電氣的に接続が可能であり、外部端子としての役割を果たすものであれば、全体に金属等の導電材料を用いる必要はない。たとえば、安全装置付外部端子の一部に導電材料とを用い、電池ケース内外を電氣的に接続するようにすればよい。

【0025】本実施形態の端子本体10の形状は、一部に他の部分(細径部)より直径の太い部分である太径部を有し、その細径部に雄ネジが形成されている。この太径部が電池ケース内部になるように取り付けられる。端子本体10にはガス抜き穴10aが形成されている。このガス抜き穴は端子本体の中心部に設けられる必要はなく、このガス抜き穴の位置は端子本体を通じて電池ケース内外を連通するものであれば、その大きさ、位置等は限定しない。このガス抜き穴10aにより電池ケース内外が連通可能となる。

【0026】このように安全装置付外部端子の端子本体にガス抜き穴を設けることにより、外部端子とは別部品で外部端子とは独立に電池ケースに取り付けられる安全装置が必要なくなり、安全装置と外部端子が一つの部品で兼ねられることから、電池組付けの際の取り付け部品点数の削減が可能となる。

【0027】なお、端子本体に太径部を設ける必要は必ずしも無く、段のない円筒形、角柱形等とすることができる。しかしながら、端子本体に太径部を設けると、この端子本体の太径部側を電池ケース内部に組み付けると端子本体の電池ケース外部のガス抜き穴開口面積に比べて、電池ケース内部のガス抜き穴開口面積を大きくすることが可能となる。そうすると、電池ケース内に封口部

材を設ける場合に、封口部材を大きくすることが可能となり、封口部材、安全装置付外部端子の加工、取り扱いが容易となる利点がある。また、安全装置付外部端子を電池ケースに組み付ける際に、この端子本体の太径部のフランジ部分が電池ケースに密着するためその部分で容易に固定できる利点がある。

【0028】ガス抜き穴を封止する封口部材は、電池内部が所定圧以上となったとき、好ましくは所定圧となったときにガス抜き穴の封止をとく、電池の内外を連通せしめるものである。

【0029】所定圧とは電池ケースの強度等に関連するもので、電池ケースが破裂する内部圧より低い圧力である。なお、この所定圧は、安全を考慮して決定する必要がある。したがって、安全が担保されるためには、実際に封口部材がガス抜き穴の封止をとく圧力の製造によるばらつきが少ないものが好ましい。

【0030】図7に本実施形態の封口部材を示す。この封口部材11の形状は有底の円筒形であり、その底部に円環状のスリット溝11aが設けられている。この封口部材はこの底部に設けられたスリット溝11aが弱体部となっており、電池内部の圧力が所定圧以上となったときに封口部材11が、スリット溝11aの部分から破断することで、封口部材11のガス抜き穴10aの封止がとけ、安全装置付外部端子1の端子本体10に設けられたガス抜き穴が電池ケース内外を連通し、内部の高圧ガスが電池ケース外に放出される。

【0031】本発明の密閉型電池に用いる封口部材としては、本実施形態以外にも、電池の密閉性を十分保つことができ、電池内部の圧力が何らかの原因で所定圧以上となるとときに、破断あるいは破裂する、いわゆる破裂弁のようなものを用いることができ、その材質構造は特に問わない。また、本実施形態では封口部材を独立の部品として説明するが、端子本体の一部に封口部材としての機能を付与するように封口部材を端子本体と一体に形成することもできる。

【0032】なお本実施形態では端子本体10を封口部材11に挿入して安全装置付外部端子1としているが、特にこの形態に限られるものではない。例えば、本発明の密閉型電池の封口部材は、金属あるいは樹脂の薄膜あるいは板状物をガス抜き穴を覆うようにして安全装置付外部端子に溶接、接着等された板状、薄膜状等のものを用いることもできる。

【0033】また、その他に本発明の密閉型電池の封口部材は、樹脂等の栓状のものであって、通常時にはガス抜き穴を閉塞するように安全装置付外部端子の端子本体にはめ込まれ、電池の内部圧上昇時にその内部圧によって抜脱されてガス抜き穴を開放させるようなもの等であってもよい。

【0034】また、本実施形態では、封口部材11を端子本体10のガス抜き穴の電池ケース3内部側に設けて

いるが、その位置は、ガス抜き穴の電池内部側、外部側、そしてガス抜き穴内部等のいずれであっても、ガス抜き穴を塞ぎ、電池ケースの密閉性を担保できるものであって、電池内部の圧力上昇によりガス抜き穴を封止する封口部材が開放されるものである限り特に問わない。ただし、好ましくは、封口部材は、端子本体の電池ケース内部に位置する部分を被覆することが好ましい。それは、最終的な電池への組み付け形態で電解液と接触する部分が封口部材に制限され、端子本体の材質の電気化学的な制約が少なくなるという利点があるからである。

【0035】そして好ましくは本実施形態と同様に封口部材の一部に弱体部を有し、電池内部の圧力が高くなると、その部分から破壊されるようにするものがよい。こうすると、弱体部の構造により、安全装置付外部端子の作動する所定圧を必要のように自由に変化させることができる利点がある。また弱体部以外は強固な構造とすることが可能となり、安全装置付外部端子製造時の取り扱いが容易となる利点もある。

【0036】弱体部としては例えば、図8(a)に示す本実施形態に用いたスリット溝を板状体の表面に膜厚を貫通しない程度に円環状11aに形成するものや、好ましくは、図8(b)に示すようにその円環の一部の溝を形成せずC形溝11b等に形成することができる。このスリット溝の深さにより安全弁付外部端子の作動する所定圧を自由に変化させることができる。スリット溝は、プレス等により形成することができる。

【0037】C型溝11bとする利点は、円環状11aに形成したもののように、封口部材の一部が残りの封口部材の一部から破断するときに完全に分離して、その分離した封口部材の一部が端子本体に設けられているガス抜き穴10aを塞ぐ危険性が無くなる点である。これは円環状11aのスリット溝と比較して、C型溝11bのスリット溝はそのスリット溝の一部が形成されていないことで、電池内部圧により破断するのは、C型に形成されたスリット溝の部分なので、そのスリット溝が形成されていない部分では封口部材は破断されずに、破断した封口部材の一部が、残りの封口部材の一部から完全に分離しないようになっているからである。こうして、弱体部をC型溝11bとすると封口部材の破断片によってガス抜き穴が、塞がれない。

【0038】その他の弱体部としては、図9に示すように封口部材の一部を薄膜11c状とすることができる。これは、封口部材自体をこのような形態に加工してもよいが、封口部材に穴を設けて、その穴に薄膜を接着等することによって作成することもできる。

【0039】また図10に示すように弱体部を封口部材に設ける代わりに、その突起により封口部材を穿孔または破断させる突起部材12を設けることもできる。封口部材11のガス抜き穴部11dが、電池ケース内部の圧力が何らかの異常で上昇したときに、突起部材12の側

に変形し、さらなる電池内部圧の上昇により、封口部材11は突起部材12に接触して、封口部材は穿孔、破断する。こうして電池の内部のガスが外部に放出される。こうすることで製造時に封口部材が破損する危険が少なくなる。また、突起部材を設けた場合でも、封口部材に弱体部を設けてもよい。

【0040】本実施形態の安全装置付外部端子1は、端子本体10を、封口部材11内に挿入し(図5(b)参照)、その後、これを圧着治具8・9により圧着することにより製造される。この圧着時に図6に示すような圧着治具8の圧着型80により封口部材11の縁部11zが内側に押しつけられ端子本体10の突起部10bと密着し、安全装置付外部端子1は完成する。このように端子本体側に封口部材を折り曲げることは、本発明の実施には本質的なものでないが、端子本体10と封口部材11と電池ケースとの密着性がよくなる利点がある。さらに、本実施形態のように端子本体の太径部のフランジ面より突出する環状の突起部を設け、封口部材がその突起部を巻き込んでその突起部に係止されるようにすることにより、より確実に封口部材と電池ケースとが密着するという利点がある。

【0041】安全装置付外部端子の材質は、特に問わないが、内部で電解液に接触する場合にその電解液と接触する部分に電気化学的に安定な材料を用いることが望ましい。本実施形態では、リチウムイオン二次電であるので正極側の安全装置付外部端子とするには、アルミニウム系の材料等から形成するのが望ましく、また、負極側の安全装置付外部端子とするには、銅系の材料、ステンレス鋼系の材料、Niメッキを施した鉄系材料等から形成するのが望ましい。なお本実施形態では、この封口部材11が電解液に直接接触する部分であるため、その材質を上述のように電気化学的に安定な材料、本実施形態ではアルミニウム製としている。

【0042】図11に安全装置付外部端子1周辺の組み付け方法、組み付け図を示す。

【0043】正極と安全装置付外部端子1の電気的な接続(集電処理)は、正極リード21dを安全装置付外部端子1の太径部に被せられた封口部材の側面に接合することにより達成される(図11(b)参照)。この接合は、機械的な接合や、超音波接合、そしてレーザー溶接などにより行うことができる。なお本実施形態では安全装置付外部端子を正極リードの集電端子としたが、別部品としての集電端子を有し、その集電端子と安全装置付外部端子1を電気的に接続してもよい。

【0044】本実施形態の負極側の集電処理は、負極リード22dを正極側と同様に負極の集電端子4に超音波接合等で接合することができる(図1参照)。

【0045】集電処理が完了した電極体2は、ケース本体32に挿設されて組み付けに供される。組付けは、ケース本体32に電極体2を挿設した後、電池ケース蓋3

1によりケース本体32を封口する。電池ケース3のケース本体32と電池ケース蓋31の間は、溶接あるいはカシメ等により密閉状態とされ、さらに必要に応じてシール材を介在させることもできる。

【0046】そして本実施例では、電極体2に取り付けられた安全装置付外部端子1と電池ケース蓋31の外部端子用孔の間は、電極間の絶縁を確保し、かつ電池の密閉性を確保するためガスケット33、34、ワッシャ35を介在させており、安全装置付外部端子1の端子本体10に雄ネジ部分と、それに対応する雌ネジを有するナット36が、螺合、密閉することができる(図11

(a)参照)。

【0047】これらガスケット、ワッシャ、ナット等は、安全弁付外部端子の取り付け方法の変更、要求される性能等に応じて、数を増減したり、無くしたり、形状を変更することができる。また端子本体に雄ネジを設けないことも可能である。そのときは溶接、接着剤による接着などの他の方法で安全装置付外部端子を電池ケースに固定してもよい。

【0048】また、負極側の集電端子4とケース本体32の底部を抵抗溶接により接合し、電池ケース3の底部を負極の外部端子とすることができる(図1参照)。

【0049】組付け時には、電極合材およびセパレータ25に電解液を含浸させる。電解液の含浸は電池ケース蓋31や、安全装置付外部端子1の接合前に行ってもよいし、電池ケース3に電解液注入口を設けることができるときには接合後にその電解液注入口から電解液を注入してもよい。リチウムイオン二次電池の場合、電解液は、エチレンカーボネート、ジエチルカーボネート等の有機溶媒に $\text{LiBF}_4$ 、 $\text{LiPF}_6$ 等の電解質を溶解させたものを使用することができる。

【0050】

【実施例】上記実施形態に基づいて本発明の密閉型電池の安全装置付外部端子について、安全装置としての機能を確認するために模擬的に電池ケースとそれに取り付けられた安全弁付外部端子を作成し、耐圧試験を行った。

【0051】以下、本発明の密閉型電池の種々の実施例について説明する。

【0052】なお、以下の実施例において使用される電池ケースは、外径50mm、肉厚0.3mmを用いた

(SUS304製)。この電池ケースと、安全装置付外部端子と電池ケースの接続部分は、それぞれ本耐圧試験の圧力範囲内で、耐圧性を有するものであった。

【0053】安全弁付外部端子は、実施形態で説明した端子本体、封口部材から構成されており、この端子本体はすべて共通のものを使用し、封口部材は形状、寸法はすべてほぼ同じであるが、封口部材に形成された弱体部を変化させた。

【0054】安全装置付外部端子の端子本体のガス抜き穴は内径8mmとした。そして、封口部材は、厚さ0.5mmのアルミニウム(A1050)製を用いた。

【0055】なお、図8、9、10に実施例で用いた封口部材等について示した。

【0056】〈実施例1〉 封口部材11aの中央に直径7.5mmの円環状のスリット溝を設けた(図8(a))。このときのスリット溝が設けられている部分の封口部材の残厚は100 $\mu\text{m}$ であった(図8(a))。

【0057】〈実施例2〉 封口部材11aを、スリット溝部分の残厚が50 $\mu\text{m}$ である点をのぞいて実施例1と同様の封口部材を使用した(図8(a))。

【0058】〈実施例3〉 封口部材11bの中央に直径12mmの円環の一部を欠いたC型のスリット溝を設けた。このときのスリット溝部分の残厚は100 $\mu\text{m}$ であった(図8(b))。

【0059】〈実施例4〉 封口部材11cの中央に直径12mmの穴をあけ、その部分に、膜厚20 $\mu\text{m}$ のアルミニウム箔を貼り付けた(図9)。

【0060】〈実施例5〉 封口部材にスリット溝や薄肉部を設ける代わりに、突起部材12を封口部材と突起部材12の先端との隙間が0.7mmとなるように設けた(図10)。

【0061】〈加圧試験〉図12に実験に用いた装置を示す。実験装置は、油圧を用いて開始圧力9kgf/cm<sup>2</sup>、加圧の圧力増加速度が毎秒1kgf/cm<sup>2</sup>で電池ケースの油圧口33から加圧を行い、安全装置が作動する圧力を各10回測定した。

【0062】〈結果〉加圧試験の結果を表1に示す。

【0063】

【表1】



	安全装置作動圧力
実施例 1	$21.0 \pm 1.0 \text{ kgf/cm}^2$
実施例 2	$16.0 \pm 1.0 \text{ kgf/cm}^2$
実施例 3	$20.0 \pm 1.0 \text{ kgf/cm}^2$
実施例 4	$19.5 \pm 0.5 \text{ kgf/cm}^2$
実施例 5	$20.0 \pm 1.5 \text{ kgf/cm}^2$

【0064】表1から明らかなように、すべての実施例について安全装置としての機能を圧力のばらつきも比較的少なく達成することが可能であった。

【0065】実施例1、2の結果より、スリット溝の膜厚を薄くすることで安全装置の作動圧を低下することができた。すなわちスリット溝の膜厚により、安全装置の作動圧を調整できることが示された。

【0066】実施例3、4、5より、種々の封口部材によっても本発明の目的を達成することができることが明らかとなった。

【0067】

【発明の効果】本発明の密閉型電池は、安全装置の機能を安全装置付外部端子に兼ね備えることにより、電池ケースに組み付ける部品点数を削減できた。この構成の電池としたことで安全装置の機能を損なわずに、電池の組み付け部品点数を削減した電池を提供することが可能となる。つまり本発明により、別途の独立部品としての安全装置を必要とせず、また別途電池の内外に余分なスペースを設けることなく、簡単な構造であってかつ安全性に優れた密閉型電池を提供することが可能となった。

【図面の簡単な説明】

【図1】実施形態の密閉型電池の断面図である。

【図2】実施形態の密閉型電池の電極体の斜視図である。

【図3】実施形態の密閉型電池の電極体の展開図である。

【図4】実施形態の密閉型電池の安全装置付外部端子の斜視図である。

【図5】実施形態の安全装置付外部端子の構成を挙げた斜視図である。

【図6】実施形態の安全装置付外部端子の製造法の一態様を挙げた断面図である。

【図7】実施形態の安全装置付外部端子の封口部材の一態様を挙げた図である。

【図8】実施例1から3で用いた封口部材を示した図である。

【図9】実施例4で用いた封口部材を示した図である。

【図10】実施例5で用いた突起部材を有する安全装置付外部端子を示した図である。

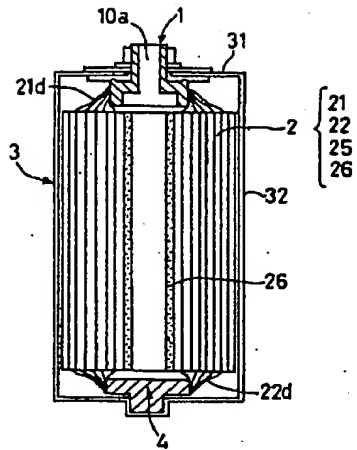
【図11】実施形態の電池ケースと安全装置付外部端子と電極体の接続の構成の一態様を挙げた断面図である。

【図12】実施例の加圧試験の実験装置を示した断面図である。

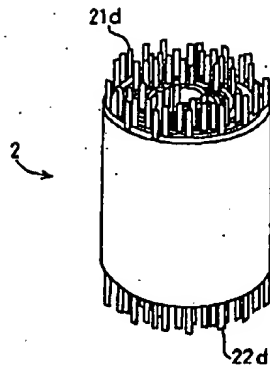
【符号の説明】

1…安全装置付外部端子  
 10…端子本体 10a…ガス抜き穴 11…封口部材 11a, 11b…スリット溝 11c…薄膜 (封口部材弱体部) 11z…縁部 12…突起部材  
 2…電極体  
 21…正極 21a…正極集電体 21b…正極合材 21c…正極合材未塗工部 21d…正極リード 22…負極 22a…負極集電体 22b…負極合材 21c…負極合材未塗工部 22d…負極リード 25…セパレータ 26…巻芯  
 3…電池ケース  
 31…電池ケース蓋 32…ケース本体  
 4…負極集電端子  
 8, 9…圧着治具

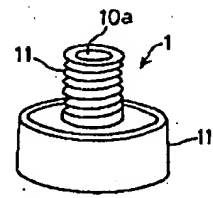
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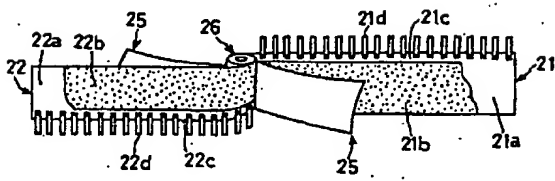
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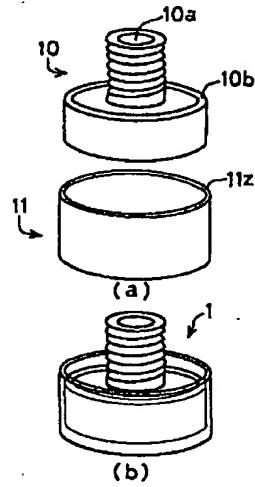
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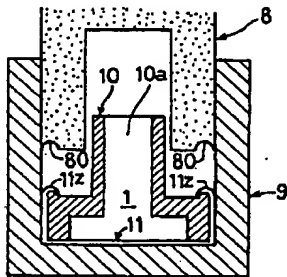
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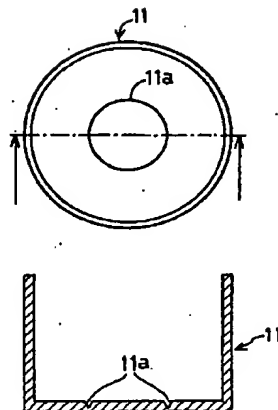
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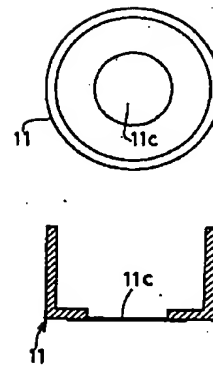
【図6】



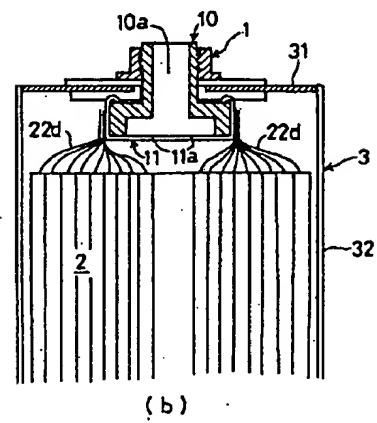
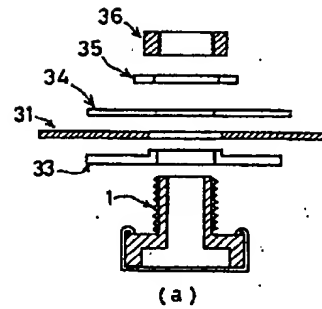
【図7】



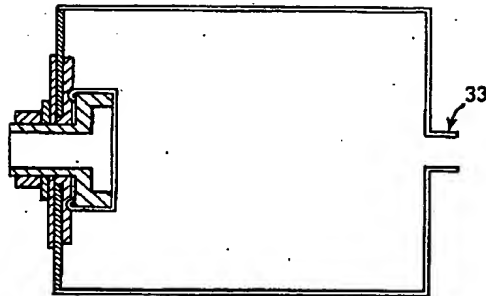
【図9】



【圖 1 1】



【図12】



フロントページの続き

(72)発明者 渡辺 吾朗  
愛知県愛知郡長久手町大字長湫字横道41番  
地の1 株式会社豊田中央研究所内

(72)発明者 中野 昭  
愛知県愛知郡長久手町大字長湫字横道41番  
地の1 株式会社豊田中央研究所内

(72)発明者 佐伯 徹  
愛知県愛知郡長久手町大字長湫字横道41番  
地の1 株式会社豊田中央研究所内

(72)発明者 野崎 耕  
愛知県豊田市トヨタ町1番地 トヨタ自動  
車株式会社内

(72)発明者 竹内 友康  
愛知県刈谷市昭和町1丁目1番地 株式会  
社デンソー内

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CC20 CC22  
5H028 AA01 AA07 BB01 CC05 CC07  
CC08 CC12 CC24

JAPANESE

[JP,2001-102025,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] A cell case, and the positive electrode, the negative electrode and the electrolytic solution by which enclosure receipt was carried out inside this cell case, It is the cell which has the external terminal by which seal maintenance was carried out in this cell case where it connected with either this positive electrode and this negative electrode electrically and this cell case is penetrated. This external terminal The closed mold cell characterized by having a terminal body with the vent hole which opens the inside and outside of this cell case for free passage, and the obturation member which makes the gas inside this cell case emit outside when this vent hole is closed and the gas pressure inside this cell case reaches more than place constant pressure.

[Claim 2] Said obturation member is a closed mold cell according to claim 1 which covers the part located in the interior of said cell case of said terminal body.

[Claim 3] It is the closed-mold cell according to claim 2 by which nothing and this large-diameter section have a flange face facing the wall of this cell case where said external terminal is held in the large-diameter section with a larger path than the part to which the part located in the interior of said cell case of said terminal body is located in this cell case exterior of this terminal body, this external terminal \*\*\*\* a gasket between this flange face and this cell case wall, and seal maintenance is carried out at this cell case.

[Claim 4] It is the closed mold cell according to claim 3 which said large diameter section has the annular height which projects from this flange face in the rim of said flange face, and said obturation member involves in this height and is stopped by this height.

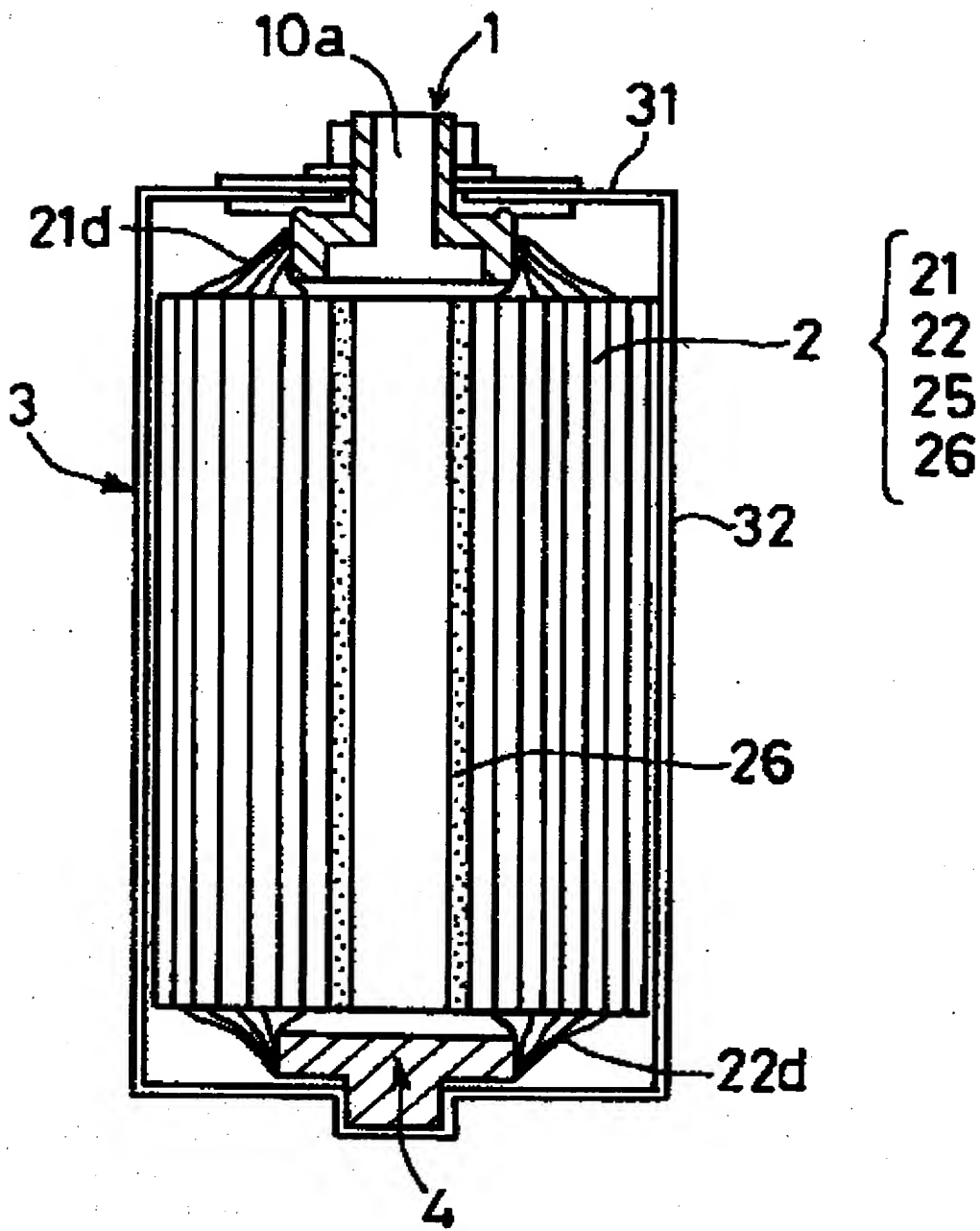
[Claim 5] Said obturation member is a closed mold cell according to claim 1 to 4 which has the weak section in the part.

[Claim 6] The configuration of said weak section is a closed mold cell according to claim 5 which is the configuration where some of annuli or annuli suffered a loss.

[Claim 7] Said external terminal is a closed mold cell according to claim 1 to 6 which has a projection member for making the obturation member which deforms with the gas pressure inside this cell case punch or fracture.

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[Translation done.]



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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the closed mold cell equipped with the safety device which makes the gas inside a cell emit to the cell exterior, when the internal pressure of a cell reaches place constant pressure.

[0002]

[Description of the Prior Art] Cordless-izing of communication equipment, such as a telephone and a personal computer, and an information related equipment, a miniaturization, and large-capacity-izing of the cell which serves as a power source from a rise of the interest about an electric vehicle and the formation of a high energy consistency are progressing quickly. A lithium cell has come to be put in practical use in some fields through a nickel-cadmium battery and a nickel hydride battery current.

[0003] the cell of such high energy consistencies including a lithium cell -- high -- high safety is called for although an activity cell reaction occurs therefore. For example, from causes, such as a short circuit inside a cell, overcharge, and heating, gas occurs so much inside a cell, and the internal pressure of a cell container must rise unusually and must also cope with the unexpected situation where a cell container explodes. So, in the cell case of closed mold cells, such as a lithium cell, when the internal pressure of a cell becomes more than place constant pressure, the safety device which emits outside the gas which occurred inside is usually formed.

[0004] A vent hole is established in a cell case, it fixes by joining the thin metal or the resin of thickness to this vent hole, and this safety device has a common relief valve using this metal or resin as a pressure open valve. When the internal pressure of a cell increases rapidly by the abnormalities of a cell, this relief valve explodes, it functions as emitting the gas inside a cell outside, and the interior of a cell is decompressed.

[0005] As the attachment location, the structure which installed the relief valve as above pressure open valves in some cell case lids as independent components as a safety device is indicated by JP,9-92249,A. Moreover, similarly JP,1-311558,A is carrying out heat adhesion of the relief valve as independent components at the cell case lid. JP,9-199088,A is also carrying out laser welding of the relief valve of a metallic thin plate to the cell case lid as independent components too further again.

[0006]

[Problem(s) to be Solved by the Invention] However, when a safety device is attached in a cell case lid, it will be necessary to attach many components in a cell case lid, and the area of a cell case lid will increase so much, for example, it will be necessary in a cylindrical cell to make the path of a cell thick, and a narrow diameter cell will have the fault that it cannot be used. And if a safety device is used as the independent components, since the attachment components mark to a cell will increase and the attachment and the stroke for installing will increase, it becomes disadvantageous in respect of cost and productivity.

[0007] this invention persons noted that there was room to equip with the function of a safety device the external terminal which are the indispensable components of a cell in view of this technical problem.

[0008] Such view hits on an idea of this invention, and it aims at offering the closed mold cell which reduced the attachment components mark to a cell, without spoiling the function of a safety device.

[0009]

[Means for Solving the Problem] Namely, the closed mold cell of this invention which solves the above-mentioned technical problem A cell case, and the positive electrode, the negative electrode and the electrolytic solution by which enclosure receipt was carried out into the cell case, It is the cell which has the external terminal by which seal maintenance was carried out in this cell case where it connected with either this positive electrode and this negative electrode electrically and this cell case is penetrated. This external terminal It is characterized by having a terminal body with the vent hole which opens the inside and outside of this cell case for free passage, and the obturation member which makes the gas within this cell case emit outside when this vent hole is closed and the gas pressure within this cell case reaches more than place constant pressure.



[0010] That is, the closed mold cell of this invention reduces the attachment components mark to a cell by having the function of a safety device for the external terminal which are the indispensable components of a cell. In addition, the external terminal which is the description section of the closed mold cell of this invention and which has the function of a safety device is hereafter called "external terminal with a safety device."

[0011]

[Embodiment of the Invention] The operation gestalt of the closed mold cell of this invention is explained to it at a detail, referring to a drawing to below. Although the following explanation is the things about a rechargeable lithium-ion battery, the closed mold cell of this invention is not restricted to this rechargeable lithium-ion battery, and if it is the cell of the structure which seals the contents which constitute a cell, it will not ask whether it is the cell of which class. For example, it is a lithium cell except having mentioned with the nickel-cadmium battery, the nickel hydride battery, and the operation gestalt etc. Since the organic electrolytic solution is used and high safety is required, especially lithium cells including a rechargeable lithium-ion battery have the large effectiveness which applies this invention. Moreover, also to the electric double layer capacitor which has the electrode in which the electrode plied timber which contains activated carbon as an active material was made to form in the shape of a layer on the surface of a charge collector, since it is applicable, the external terminal structure with a safety device by which it is characterized [ of the closed mold cell of this invention ] shall also include the semantics of a "capacitor" with a "cell" in this specification. In addition, since only an important section is typically expressed about a drawing, it is not what was expressed to accuracy even about the configuration of details, and the scale.

[0012] The sectional view of the cylindrical rechargeable lithium-ion battery which is 1 operation gestalt of the closed mold cell of this invention is typically shown in drawing 1 .

[0013] This closed mold cell has the cell contents 2 (henceforth an "electrode object") which wound and formed the positive electrode 21 and the negative electrode 22 centering on the winding core 26 through the separator 25, and this electrode object 2 is inserted in the telescopic cell case 3 with the electrolytic solution. And it connects with the positive electrode 21 electrically, and has the external terminal 1 with a safety device held at this cell case 3 where this cell case 3 is penetrated. In addition, by the closed mold cell of this operation gestalt, although it connects with the positive electrode 21 electrically, the external terminal 1 with a safety device is not restricted when connecting with a positive electrode electrically, but may connect electrically the external terminal with a safety device of the closed mold cell of this invention to a negative electrode. Moreover, from a safety aspect, if the vent hole of extensive area is more required, it is good also considering the both sides of the external terminal of a positive electrode and a negative electrode as an external terminal with a safety device. The side which did not adopt an external terminal with a safety device at this time can prepare the external terminal which it is not independently with a safety device, and can be taken as the external terminal of the well-known gestalt of using some cell cases as an external terminal.

[0014] The perspective view of the electrode object of the closed mold cell of this operation gestalt is shown in drawing 2 , and the development view of the electrode object of this operation gestalt is typically shown in drawing 3 , respectively.

[0015] A positive electrode 21 and a negative electrode 22 are arranged so that positive-electrode lead 21d and negative-electrode lead 22d may face in opposite directions, respectively, they and the separator 25 of two sheets accumulate them repeatedly in order of a positive electrode 21, a separator 25, a negative electrode 22, and a separator 25, and the electrode object 2 uses them as winding and a cylindrical shape spirally by making these into one at a winding core 26. In addition, it is not restricted to a cylindrical shape, but the laminating of two or more positive electrodes, a negative electrode, and the separator is carried out, and the configuration of the electrode object 2 can be considered as a square shape.

[0016] A positive electrode 21 consists of positive-electrode lead 21d for current collection formed in positive-electrode charge collector 21a made from a band-like metallic foil, and its both sides at the end section (positive-electrode plied timber sheep coating section 21c) of the cross direction of positive-electrode plied timber 21b and a positive-electrode charge collector by which coating was carried out. A negative electrode 22 consists of negative-electrode lead 22d for current collection formed in negative-electrode charge collector 22a made from a band-like metallic foil, and its both sides at the end section (negative-electrode plied timber sheep coating section 22c) of the cross direction of negative-electrode plied timber 22b and negative-electrode charge collector 22a by which coating was carried out. Positive-electrode plied timber sheep coating section 21c and negative-electrode plied timber sheep coating section 22c are prepared in the positive electrode 21 and the negative electrode 22 at the crosswise end section covering the overall length, respectively by predetermined width of face. About the die length and width of face of a positive electrode 21 and a negative electrode 22, it can consider as the thing of arbitration according to the capacity of the cell which it is going to create etc.

[0017] What is necessary is just to use metallic foils, such as aluminum, for positive-electrode charge collector 21a. Positive-electrode plied timber 21b should just use what has the well-known thing which mixed binders,

such as electric conduction material, such as a graphite, and polyvinylidene fluoride, for the positive active material which consists of lithium multiple oxide powder etc. What is necessary is just to use metallic foils, such as copper, for negative-electrode charge collector 22a. Negative-electrode plied timber 22b can use what has the well-known thing which mixed binding material, such as polyvinylidene fluoride, for the negative-electrode active material which consists of carbon material powder, such as a graphite.

[0018] As for positive-electrode lead 21d and negative-electrode lead 22d, it is desirable to use the same metal as the charge collectors 21a and 22a of each electrode. Therefore, aluminum etc. is used in a positive electrode and copper etc. is used in a negative electrode. What is necessary is just to make the gestalt into the shape of a strip of paper etc. It is necessary to make a number (positive-electrode lead 21d and negative-electrode lead 22d) into plurality in order to make internal resistance low as discharge capacity becomes large. Although it is plurality positive-electrode lead 22d and negative-electrode lead 22d with this operation gestalt since the mass cell is used, especially the number of leads is not asked.

[0019] In the case of this rechargeable lithium-ion battery, the winding core 26 is made into the cylinder-like configuration. However, according to the configuration of the electrode object 2, you may have the cross section of the thing and ellipse form which have the cross section of the polygon of the square pole etc. according to various configurations 2, for example, electrode object.

[0020] A separator 25 insulates electrically a positive electrode 21 and a negative electrode 22, and plays the role holding the electrolytic solution, and fine porous membrane, such as polyethylene, should just be used for it. In addition, as for a separator 25, it is desirable to consider as a still larger thing than a positive electrode 21 and a negative electrode 22 in order to collateralize the insulation with a positive electrode 21 and a negative electrode 22.

[0021] The cell case 3 in this operation gestalt consists of a bell shape case body 32 of an owner bottom, and a cell case lid 31 which blockades the upper limit of a case body. The hole for external terminals is prepared in the center section of this cell case lid 31, and the external terminal 1 with a safety device is inserted in this hole for external terminals. Although a cell case is a cylindrical shape in the gestalt of this operation, it is not restricted to a cylindrical shape and is good also as a square shape etc. according to the configuration of an electrode object. In that case, a cell case is constituted by the wall surface member according to the configuration.

[0022] The external terminal with a safety device which is the description section of the closed mold cell of this invention is characterized by having a terminal body with the vent hole which opens the inside and outside of a cell case for free passage, and the obturation member which makes the gas within this cell case emit outside when a vent hole is closed and the gas pressure within a cell case reaches more than place constant pressure.

[0023] Each component of the external terminal with a safety device of this operation gestalt is shown in drawing 5, and the manufacturing method of the external terminal with a safety device of this operation gestalt is typically shown for the perspective view of the external terminal with a safety device of this operation gestalt in drawing 4 at drawing 6, respectively.

[0024] The external terminal 1 with a safety device of this operation gestalt consists of a terminal body 10 and an obturation member 11 (refer to drawing 5 (a)). With this operation gestalt, the whole is metal and this terminal body 10 and the obturation member 11 have conductivity. In addition, if the external terminal with a safety device can connect electrically the inside of a cell case, and the outside of a cell case and a role of an external terminal is played, it is not necessary to use electrical conducting materials, such as a metal, for the whole. For example, what is necessary is to use an electrical conducting material for some external terminals with a safety device, and just to connect the inside and outside of a cell case electrically.

[0025] The configuration of the terminal body 10 of this operation gestalt has in a part the large diameter section which is a part with a diameter thicker than other parts (thin diameter section), and the male screw is formed in the thin diameter section. It is attached so that this large diameter section may turn into the interior of a cell case. Vent hole 10a is formed in the terminal body 10. If this vent hole does not need to be established in the core of a terminal body and the location of this vent hole opens the inside and outside of a cell case for free passage through a terminal body, that magnitude, a location, etc. will not be limited. The free passage of the inside and outside of a cell case is attained by this vent hole 10a.

[0026] Thus, by establishing a vent hole in the terminal body of an external terminal with a safety device, the safety device attached in a cell case independently of an external terminal with another components becomes unnecessary, and it becomes an external terminal reducible [ the fittings mark in the case of cell attachment ] from serving both as a safety device and an external terminal with one components.

[0027] In addition, there is not necessarily no need of preparing the large diameter section in a terminal body, and it can be made into a cylindrical shape, a prism form, etc. without a stage. However, if the large diameter section is prepared in a terminal body, and the large diameter section side of this terminal body is attached to the interior of a cell case, compared with the vent hole opening area of the cell case exterior of a terminal body, it

will become possible to enlarge vent hole opening area inside a cell case. If it does so, when preparing an obturation member in a cell case, there is an advantage from which it becomes possible from which to enlarge an obturation member, and processing of an obturation member and an external terminal with a safety device and handling become easy. Moreover, in case an external terminal with a safety device is attached to a cell case, in order for the amount of [ of the large diameter section of this terminal body ] flange to stick to a cell case, there is an advantage easily fixable in that part.

[0028] When the interior of a cell becomes more than place constant pressure, when the obturation member which closes a vent hole becomes place constant pressure preferably, it solves the closure of a vent hole, and makes the inside and outside of a cell open for free passage.

[0029] Place constant pressure is a pressure lower than the internal pressure in which a cell case explodes in relation to the reinforcement of a cell case etc. In addition, it is necessary to determine this place constant pressure in consideration of insurance. Therefore, in order to collateralize insurance, what has actually few dispersion according [ an obturation member ] the closure of a vent hole to manufacture of a profit pressure is desirable.

[0030] The obturation member of this operation gestalt is shown in drawing 7 . The configuration of this obturation member 11 is the cylindrical shape of an owner bottom, and circular ring-like slit slot 11a is prepared in that pars basilaris ossis occipitalis. This obturation member is that the obturation member 11 fractures from the part of slit slot 11a, when slit slot 11a prepared in this pars basilaris ossis occipitalis is the weak section and the pressure inside a cell becomes more than place constant pressure. The closure of vent hole 10a of the obturation member 11 solves, the vent hole established in the terminal body 10 of the external terminal 1 with a safety device opens the inside and outside of a cell case for free passage, and internal high pressure gas is emitted out of a cell case.

[0031] When the sealing nature of a cell can be maintained enough and the pressure inside a cell becomes more than place constant pressure by a certain cause as an obturation member used for the closed mold cell of this invention besides this operation gestalt, a thing like the so-called burst valve which fractures or explodes can be used, and especially the quality-of-the-material structure is not asked. Moreover, although this operation gestalt explains an obturation member as independent components, an obturation member can also be formed in a terminal body and one so that the function as an obturation member may be given to some terminal bodies.

[0032] In addition, although the terminal body 10 is inserted in the obturation member 11 and considered as the external terminal 1 with a safety device with this operation gestalt, it is not restricted to especially this gestalt. For example, things by which welding, adhesion, etc. were carried out to the external terminal with a safety device in the thin film or tabular object of a metal or resin, such as the shape of tabular and a thin film, as cover a vent hole can also be used for the obturation member of the closed mold cell of this invention.

[0033] It seems that moreover, the obturation member of the closed mold cell of this invention is the thing of the shape of a plug, such as resin, it is inserted in the terminal body of an external terminal with a safety device so that a vent hole may usually sometimes be blockaded, is pulled out by the internal pressure at the time of an internal pressure rise of a cell, and may make a vent hole open wide in addition to this.

[0034] Moreover, with this operation gestalt, although the obturation member 11 is formed in the interior side of cell case 3 of the vent hole of the terminal body 10, the location plugs up a vent hole, can collateralize the sealing nature of a cell case, and even if it is any, such as an interior side of a cell of a vent hole, an exterior side, and the interior of a vent hole, especially as long as the obturation member which closes a vent hole by the pressure buildup inside a cell is opened wide, it does not ask it. However, as for an obturation member, it is desirable preferably to cover the part located in the interior of the cell case of a terminal body. That is because there is an advantage that the part which contacts the electrolytic solution with the attachment gestalt to a final cell is restricted to an obturation member, and electrochemical constraint of the quality of the material of a terminal body decreases.

[0035] And when it has the weak section in a part of obturation member like [ it is desirable and ] this operation gestalt and the pressure inside a cell becomes high, what is destroyed from the part is good. When it carries out like this, there is an advantage to which the place constant pressure to which an external terminal with a safety device operates can be freely changed according to the structure of the weak section so that it may be required. Moreover, there is also an advantage from which it becomes possible from which to consider as firm structure, and the handling at the time of the external terminal manufacture with a safety device becomes easy except the weak section.

[0036] what forms the slit slot used for this operation gestalt shown in drawing 8 (a) as the weak section in extent which does not penetrate thickness on the surface of a plate at in-a-circle 11a -- preferably, as shown in drawing 8 (b), some slots of the circular ring cannot be formed, but it can form in C form slot 11b etc. The place constant pressure to which an external terminal with a relief valve operates by this slit depth of flute can be changed freely. A slit slot can be formed with a press etc.

[0037] The advantage set to C mold groove 11b is a point whose danger of closing vent hole 10a which dissociates completely when a part of obturation member fractures from a part of remaining obturation members like, although formed in in-a-circle 11a, and by which a part of the separated obturation member is prepared in the terminal body disappears. That this is that a part of the slit slot is not formed, and fractures the slit slot of C mold groove 11b by cell internal pressure as compared with the slit slot of in-a-circle 11a. It is because it is the part of the slit slot formed in C mold, so a part of fractured obturation member separates an obturation member from a part of remaining obturation members completely in the part in which the slit slot is not formed, without being fractured. In this way, a vent hole will not be closed by the piece of fracture of an obturation member if the weak section is set to C mold groove 11b.

[0038] As the other weak sections, as shown in drawing 9, a part of obturation member can be made into the shape of thin film 11c. Although this may process the obturation member itself into such a gestalt, it can establish a hole in an obturation member, and when adhesion etc. makes a thin film the hole, it can also create it.

[0039] Moreover, instead of preparing the weak section in an obturation member, as shown in drawing 10, the projection member 12 which makes an obturation member punch or fracture by the projection can also be formed. 11d of vent hole sections of the obturation member 11 deforms into the projection member 12 side, when the pressure inside a cell case rises by a certain abnormalities, and by the rise of the further cell internal pressure, the obturation member 11 contacts the projection member 12, and punches and fractures an obturation member. In this way, the gas inside a cell is emitted outside. Risk of an obturation member being damaged by carrying out like this at the time of manufacture decreases. Moreover, even when a projection member is prepared, the weak section may be prepared in an obturation member.

[0040] The external terminal 1 with a safety device of this operation gestalt inserts the terminal body 10 into the obturation member 11 (refer to drawing 5 (b)), and is manufactured by sticking this by pressure with the sticking-by-pressure fixture 8-9 after that. Edge 11z of the obturation member 11 is forced inside with the sticking-by-pressure mold 80 of the sticking-by-pressure fixture 8 as shown in drawing 6 at the time of this sticking by pressure, it sticks with height 10b of the terminal body 10, and the external terminal 1 with a safety device is completed. Thus, bending an obturation member to a terminal body side has the advantage to which the adhesion of the terminal body 10, the obturation member 11, and a cell case becomes good, although it is not essential to operation of this invention. Furthermore, when the annular height which projects from the flange face of the large diameter section of a terminal body like this operation gestalt is prepared, and an obturation member involves in the height and is made to be stopped by the height, there is an advantage that an obturation member and a cell case stick more certainly.

[0041] Although not asked, when contacting the electrolytic solution inside, as for especially the quality of the material of an external terminal with a safety device, it is desirable to use a stable ingredient for the part in contact with the electrolytic solution electrochemically. It is desirable to form from the ingredient of an aluminum system etc., in order to consider as the external terminal with a safety device by the side of a positive electrode with this operation gestalt, since it is second lithium ion \*\*, and in order to consider as the external terminal with a safety device by the side of a negative electrode, it is desirable to form from the ingredient of a copper system, the ingredient of a stainless steel system, the iron system ingredient that performed nickel plating. In addition, since this obturation member 11 is the part which contacts the electrolytic solution directly with this operation gestalt, that quality of the material is electrochemically made into the product made from aluminum with the stable ingredient and this operation gestalt as mentioned above.

[0042] The approach the external terminal with safety device 1 circumference should clinch drawing 11, and an attachment Fig. are shown.

[0043] Electric connection (current collection processing) of a positive electrode and the external terminal 1 with a safety device is attained by joining positive-electrode lead 21d to the side face of the obturation member covered by the large diameter section of the external terminal 1 with a safety device (refer to drawing 11 (b)). Mechanical junction, ultrasonic jointing, laser welding, etc. can perform this junction. In addition, although considered as the current collection terminal of a positive-electrode lead of an external terminal with a safety device with this operation gestalt, it has a current collection terminal as another components, and the current collection terminal and the external terminal 1 with a safety device may be connected electrically.

[0044] The current collection processing by the side of the negative electrode of this operation gestalt can join negative-electrode lead 22d to the charge collector terminal 4 of a negative electrode by ultrasonic jointing etc. like a positive-electrode side (refer to drawing 1). [0045] The electrode object 2 which current collection processing completed is inserted in the case body 32, and attachment is presented with it. After attachment inserts the electrode object 2 in the case body 32, it obturates the case body 32 with the cell case lid 31. Between the case body 32 of the cell case 3, and the cell case lid 31, it is made into a sealing condition with welding or caulking, and it can also make a sealant intervene if needed further.

[0046] In this example, and between the external terminal 1 with a safety device attached in the electrode object 2, and the hole for external terminals of the cell case lid 31 In order to secure an inter-electrode insulation and to secure the sealing nature of a cell, gaskets 33 and 34 and a washer 35 are made to intervene. On the terminal body 10 of the external terminal 1 with a safety device A male screw part, The nut 36 which has a female screw corresponding to it can screw and seal (refer to drawing 11 (a)).

[0047] According to modification of the mounting arrangement of an external terminal with a relief valve, the engine performance demanded, a number can be fluctuated, it can lose or these gaskets, a washer, a nut, etc. can change a configuration. Moreover, it is also possible not to form a male screw in a terminal body. An external terminal with a safety device may be then fixed to a cell case by other approaches, such as welding and adhesion by adhesives.

[0048] Moreover, the pars basilaris ossis occipitalis of the case body 32 can be joined to the current collection terminal 4 by the side of a negative electrode by resistance welding, and the pars basilaris ossis occipitalis of the cell case 3 can be used as the external terminal of a negative electrode (refer to drawing 1 ).

[0049] The electrolytic solution is infiltrated into electrode plied timber and a separator 25 at the time of attachment. You may perform sinking [ of the electrolytic solution ] in before the cell case lid 31 and junction of the external terminal 1 with a safety device, and when an electrolytic-solution inlet can be established in the cell case 3, the electrolytic solution may be poured in from the electrolytic-solution inlet after junction. In the case of a rechargeable lithium-ion battery, what dissolved the electrolyte of  $\text{LiBF}_4$  and  $\text{LiPF}_6$  grade in organic solvents, such as ethylene carbonate and diethyl carbonate, can be used for the electrolytic solution.

[0050]

[Example] In order to check the function as a safety device based on the above-mentioned operation gestalt about the external terminal with a safety device of the closed mold cell of this invention, the external terminal with a relief valve attached in a cell case and it in simulation was created, and the compressive test was performed.

[0051] Hereafter, the various examples of the closed mold cell of this invention are explained.

[0052] In addition, the outer diameter of 50mm and the thickness of 0.3mm were used for the cell case used in the following examples (product made from SUS304). The connection parts of this cell case, and an external terminal with a safety device and a cell case were what has pressure resistance in the pressure range of this compressive test, respectively.

[0053] The external terminal with a relief valve consists of the terminal bodies and obturation members which were explained with the operation gestalt, the whole of this terminal body uses a common thing, and although all of a configuration and a dimension of an obturation member are almost the same, the weak section formed in the obturation member was changed.

[0054] The vent hole of the terminal body of an external terminal with a safety device was made into the bore of 8mm. And the product with a thickness of 0.5mm made from aluminum (A1050) was used for the obturation member.

[0055] In addition, drawing 8 , the obturation member used for 9 and 10 in the example were shown.

[0056] <Example 1> The slit slot of the shape of a circular ring with a diameter of 7.5mm was prepared in the center of obturation member 11a ( drawing 8 (a) ). The remaining thickness of the obturation member of the part in which the slit slot at this time is established was 100 micrometers ( drawing 8 (a) ).

[0057] <Example 2> The same obturation member as an example 1 was used except the point that the remaining thickness for a slit slot is 50 micrometers about obturation member 11a ( drawing 8 (a) ).

[0058] <Example 3> The slit slot of C mold lacking in some circular rings with a diameter of 12mm was prepared in the center of obturation member 11b. The remaining thickness for a slit slot at this time was 100 micrometers ( drawing 8 (b) ).

[0059] <Example 4> The hole with a diameter of 12mm was made in the center of obturation member 11c, and the aluminium foil of 20 micrometers of thickness was stuck on the part ( drawing 9 ).

[0060] <Example 5> Instead of preparing a slit slot and a thin-walled part in an obturation member, the projection member 12 was formed so that the clearance between the tips of an obturation member and the projection member 12 might be set to 0.7mm ( drawing 10 ).

[0061] <Pressure test> The equipment used for the experiment at drawing 12 is shown. Initiation pressure 9 kgf/cm<sup>2</sup> and the pressure increase acceleration of pressurization performed pressurization from the oil pressure opening 33 of a cell case by per second 1 kgf/cm<sup>2</sup> using oil pressure, and the experimental device measured the pressure to which a safety device operates 10 times each.

[0062] <Result> The result of a pressure test is shown in Table 1.

[0063]

[Table 1]

	安全装置作動圧力
実施例 1	21.0 ± 1.0 kgf / cm <sup>2</sup>
実施例 2	16.0 ± 1.0 kgf / cm <sup>2</sup>
実施例 3	20.0 ± 1.0 kgf / cm <sup>2</sup>
実施例 4	19.5 ± 0.5 kgf / cm <sup>2</sup>
実施例 5	20.0 ± 1.5 kgf / cm <sup>2</sup>

[0064] It was possible for there to also have been comparatively little dispersion in a pressure and to have attained the function as a safety device about all examples, so that clearly from Table 1.

[0065] The working pressure of a safety device was able to be fallen by making thickness of a slit slot thin from the result of examples 1 and 2. That is, it was shown by the thickness of a slit slot that the working pressure of a safety device can be prepared.

[0066] It became clear from examples 3, 4, and 5 that the purpose of this invention can be attained also by various obturation members.

[0067]

[Effect of the Invention] The closed mold cell of this invention has reduced the components mark attached to a cell case by having the function of a safety device for an external terminal with a safety device. It becomes possible to offer the cell which reduced the attachment components mark of a cell, without spoiling the function of a safety device by having considered as the cell of this configuration. That is, it became possible to offer the closed mold cell which is easy structure and was excellent in safety, without having not needed the safety device as special independent components, and providing an excessive tooth space within and without a cell separately by this invention.

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[Translation done.]



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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the closed mold cell of an operation gestalt.

[Drawing 2] It is the perspective view of the electrode object of the closed mold cell of an operation gestalt.

[Drawing 3] It is the development view of the electrode object of the closed mold cell of an operation gestalt.

[Drawing 4] It is the perspective view of the external terminal with a safety device of the closed mold cell of an operation gestalt.

[Drawing 5] It is the perspective view which mentioned the configuration of the external terminal with a safety device of an operation gestalt.

[Drawing 6] It is the sectional view which mentioned one mode of the manufacturing method of the external terminal with a safety device of an operation gestalt.

[Drawing 7] It is drawing which mentioned one mode of the obturation member of the external terminal with a safety device of an operation gestalt.

[Drawing 8] It is drawing having shown the obturation member used in the examples 1-3.

[Drawing 9] It is drawing having shown the obturation member used in the example 4.

[Drawing 10] It is drawing having shown the external terminal with a safety device which has the projection member used in the example 5.

[Drawing 11] It is the sectional view which mentioned one mode of the configuration of connection of the cell case of an operation gestalt, an external terminal with a safety device, and an electrode object.

[Drawing 12] It is the sectional view having shown the experimental device of the pressure test of an example.

## [Description of Notations]

1 -- External terminal with a safety device

10 -- Terminal body 10a -- Vent hole 11 -- Obturation member 11a, 11b -- Slit slot 11c -- Thin film (obturation member weak section) 11z -- Edge 12 -- Projection member

2 -- Electrode object

21 -- Positive electrode 21a -- Positive-electrode charge collector 21b -- Positive-electrode plied timber 21c --

Positive-electrode plied timber sheep coating section 21d -- Positive-electrode lead 22 -- Negative electrode 22a -- Negative-electrode charge collector

22b -- Negative-electrode plied timber 21c -- Negative-electrode plied timber sheep coating section 22d --

Negative-electrode lead 25 -- Separator 26 -- Winding core

3 -- Cell case

31 -- Cell case lid 32 -- Case body

4 -- Negative-electrode current collection terminal

8 9 -- Sticking-by-pressure fixture

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[Translation done.]

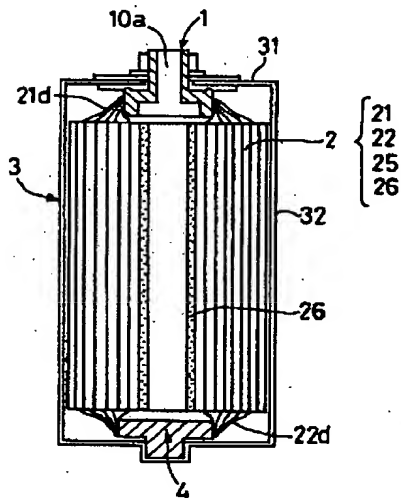
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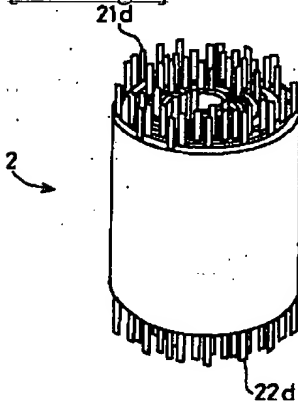
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## DRAWINGS

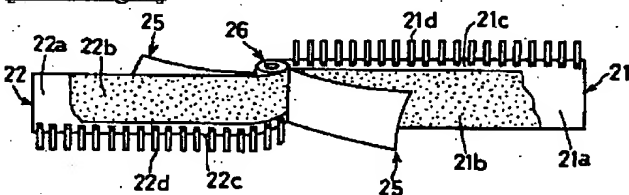
[Drawing 1]



[Drawing 2]

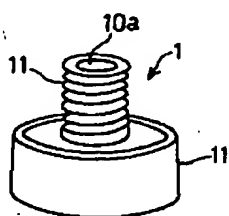


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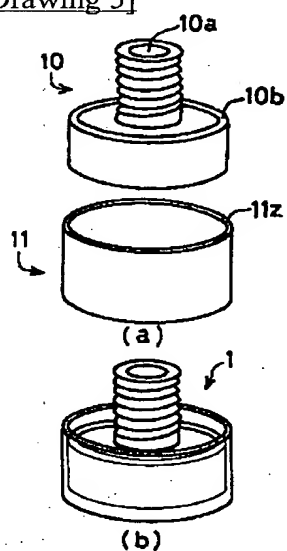


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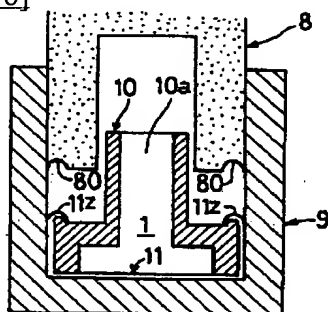




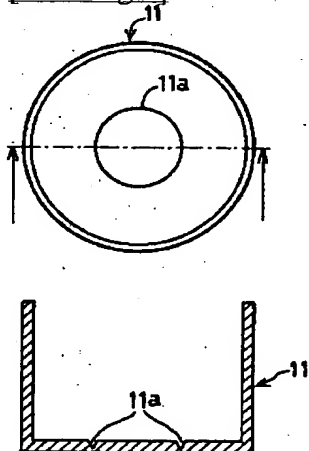
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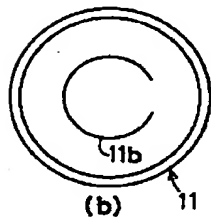
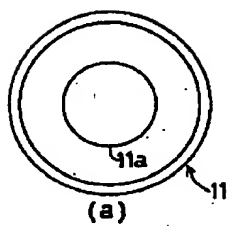
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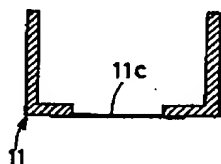
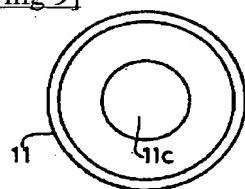
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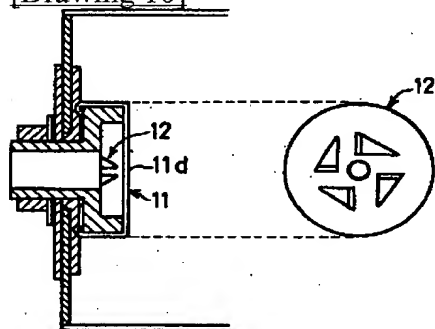
[Drawing 8]



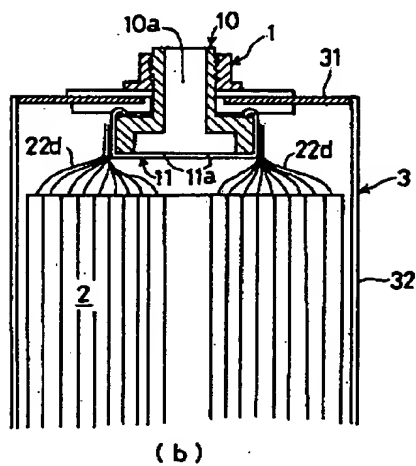
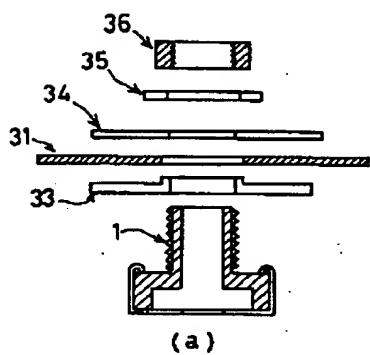
[Drawing 9]



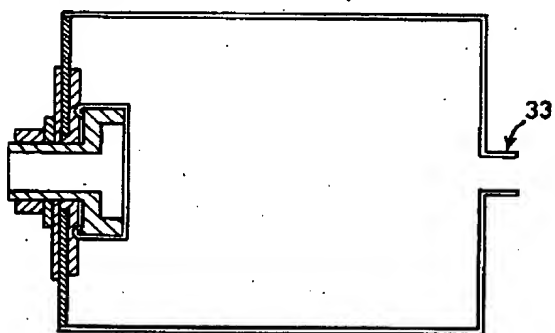
[Drawing 10]



[Drawing 11]



[Drawing 12]



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